# MEDACS USER MANUAL
# (Universal Input Versions)

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# 1 Introduction

## 1.1 Description of Range

The MEDACS series consists of a range of DIN rail signal conditioning units. There are 2 different basic types available; single (21XX) or dual (22XX) input channel.

MEDACS 21XX Single Input Channel Unit

MEDACS 22XX Dual Input Channel Unit

Both units are equipped with 2 output channels. On the 21XX units, both output channels are derived from the single input channel. On the 22XX units, output channel 1 is derived from input channel 1, and output channel 2 is derived from input channel 2.

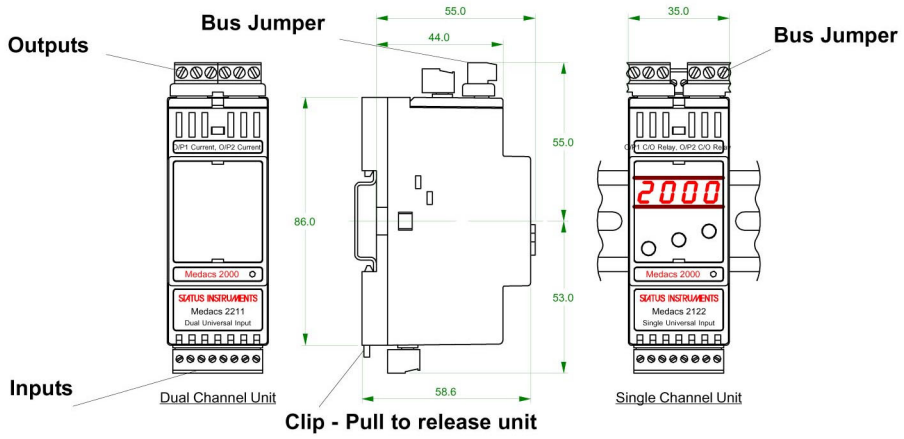
MEDACS units have powerful standard functions, which the user can easily configure via front panel display menu access, or via RS-485 Modbus communications. This standard functionality is explained in detail in this manual. MEDACS functionality can be greatly extended by the inclusion of TFML (Transfer Function Module Library). TFML was designed by Status to allow the user enhanced power and flexibility by providing a mechanism whereby each unit can be customised to perform a particular function. For standard functionality, the MEDACS user needs no knowledge of TFML.

If the user wishes to use an existing TFML application, he/she should be aware of the functionality of the TFML module, but no knowledge/understanding of HOW the TFML was written is required. TFML modules are downloaded to MEDACS units using M-Config, Status' PC-based configuration package. TFML modules are available for download from the Status website www.status.co.uk. If the user has a custom application which requires a new TFML, contact the distributor. This manual doesn't detail the TFML functionality of the MEDACS units.

## 1.2 Installation

THIS SECTION FOR USE BY COMPETENT PERSONNEL ONLY

Care must be taken when installing units into an enclosure to ensure that the ambient temperature range is not exceeded. Power supply units can produce heat and if possible are best mounted in a separate enclosure away from the Medacs units.




**Installation detail**

### 1.2.1 Unpacking

Please inspect the instrument carefully for any signs of shipping damage. The packaging has been designed to afford maximum protection, however, we cannot guarantee that mishandling will not have damaged the instrument. In the case of this unlikely event, please contact your supplier immediately and retain the packaging for subsequent inspection.

### 1.2.2 Safety Information

WARNING The equipment must be installed by suitably qualified personnel and mounted in an enclosure providing protection to at least IP20. The equipment contains no user serviceable parts.

### 1.2.3 Isolation

The 24V DC power supply and RS485 communications bus share the same common ground. Isolation is provided between input, output and supply/comms. The isolation voltage is 500V AC RMS, and has been flash tested to 1KV DC.

## 1.3 Input types

MEDACS units will accept the following input types:

RTD, Thermocouple, Current (mA - passive or active), Voltage (mV or V).

On 21XX units, there are 2 discrete inputs available.

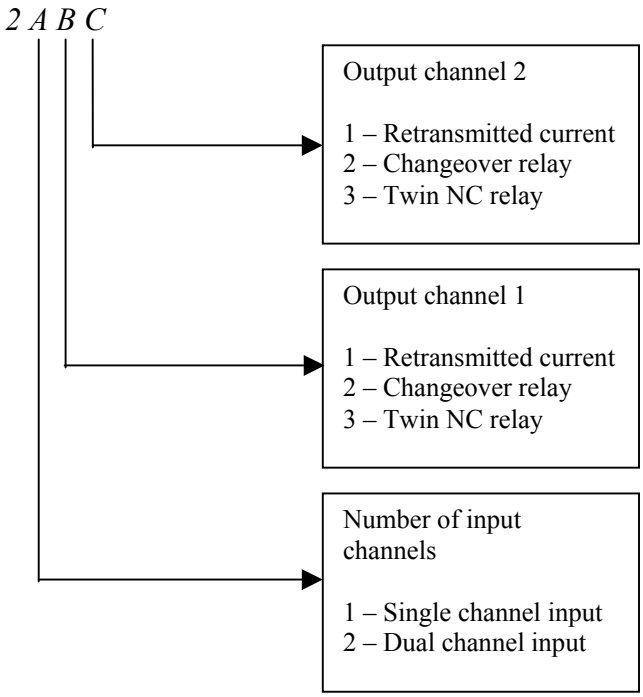
## 1.4 Output Types

Each of the 2 output channels is available in the following forms:

Current retransmission
Changeover relay
Twin relay (2 normally relays per channel)

## 1.5 Input Output Variants

The part number system adopts the following format:


2 A B C
Output channel 2
1 – Retransmitted current
2 – Changeover relay
3 – Twin NC relay
Output channel 1
1 – Retransmitted current
2 – Changeover relay
3 – Twin NC relay
Number of input channels
1 – Single channel input
2 – Dual channel input

There are limitations on the input/output combinations available, as shown in the following table

| Part number | Number of input channels | Output channel 1 | Output channel 2 |
|---|---|---|---|
| 2122 | 1 | C/O relay | C/O relay |
| 2113 | 1 | Current | Twin relay |
| 2133 | 1 | Twin relay | Twin relay |
| 2211 | 2 | Current | Current |
| 2222 | 2 | C/O relay | C/O relay |
| 2233 | 2 | Twin relay | Twin relay |
| 2213 | 2 | Current | Twin relay |

## 1.6 Configuration

Each unit is equipped with RS485 Modbus serial communications. This enables any unit to be configured/monitored via comms. This manual documents the MEDACS Modbus implementation detail. With this information, the user may use any Modbus generic driver to communicate with a MEDACS unit. Status Instruments have written a Windows configuration package, called M-Config, which enables the user to quickly and easily communicate with MEDACS units without having an in-depth knowledge of the Modbus implementation. (Note – for multi-drop communications, see the section 5.3.1, which describes the operation of the Network Enable Passcode). Whether configuring via comms or menu access, all configuration data is written directly to non-volatile memory.

The 21XX units have the added advantage of local configuration via a menu structure accessible from the front panel keys/display.

# 2 Specification

## 2.1 Inputs

MEDACS units can accept the following input types.

| Input | Ranges available |
|---|---|
| RTD | Pt100, Ni120 |
| Thermocouple | K, J, T, R, S, E, F, N, B |
| Current | 4-20, ±20, ±10mA |
| Voltage | ±0.1, ±10, ±1, ±5, 1-5V |

### 2.1.1 RTD

| | |
|---|---|
| Sensor range | -200 to 850°C |
| Linearisation | Pt100(BS EN 60751/JISC 1604)/Ni120/Custom |
| Basic accuracy | 0.1°C ± 0.05% of reading |
| Thermal drift (zero) | ±0.004Ω/°C |
| Thermal drift (span) | 100ppm /°C |
| Excitation current: | 300mA to 550mA |
| Lead resistance effect | 0.002 °C/Ω |
| Max lead resistance | 50Ω/leg |

### 2.1.2 Thermocouple

| Type | Range (°C) |
|---|---|
| K | -200 TO 1370 |
| J | -200 to 1200 |
| T | -210 to 400 |
| R | -10 to 1760 |
| S | -10 to 1760 |
| E | -200 to 1000 |
| F | -100 to 600 |
| N | -180 to 1300 |
| B | -10 to 1650 |
| Custom | user defined |

Basic accuracy: ± 0.04% FS or ± 0.04% reading or ±0.5°C, whichever is greater
(For type R & S, stated accuracy only applies between 800 & 1760°C)
(For type B, stated accuracy only applies between 400 & 1650°C)
Linearisation: BS4937 / IEC 584-3 / Custom
Cold juction error: ±0.5°C
Cold junction tracking: 0.05°C/°C
Cold junction range: -20 to 70°C
Thermal drift (zero): ± 4µV/°C
Thermal drift (span): ± 200ppm /°C

### 2.1.3 Current

| | |
|---|---|
| Range | 4-20mA, ±20mA, ±10mA |
| Accuracy | 0.05% FS ± 0.05% of reading |
| Thermal drift | 200ppm/°C |
| Input impedance | 20Ω |
| Linearisation | Linear, Square root, Power 3/2, Power 5/2, Custom* |

### 2.1.4 Voltage

| | |
|---|---|
| Range | ±100mV, ±1V, ±5V, ±10V, 1-5V |
| Accuracy | 0.04%FS ±0.04% of reading |
| Thermal drift | 200ppm/°C |
| Input impedance | 1MΩ |
| Linearisation | Linear, Square root, Power 3/2, Power 5/2, Custom* |

* Custom linearisation available as interpolation or segmented polynomials. See section 5.9 for more details.

### 2.1.5 Digital inputs

There are 2 digital inputs available on 21XX units; DIG1 & DIG2. These can be TTL, open collector, 24V dc logic or potential free contacts.

DIG1 is used to perform reset/clear functions. It is also available for customised use with TFML.
DIG2 is solely available for customised use with TFML.

There are no digital inputs available on 22XX units.

## 2.2 Outputs

### 2.2.1 Relays

Two relay options are available, either a single changeover or twin independent relays with normally closed contacts. Contacts are Normally Closed i.e the contact is open at power off and when operating in the absence of an alarm condition. The contact closes when an alarm is detected. The active function can be reversed in the software.

| | |
|---|---|
| Alarm Action | Off, High, Low, Deviation, Test |
| Hysteresis | Programmable 0 to 100% |
| Delay Time | Programmable (Alarm must be continuously present for this period |
| in order to be recognised) | |
| Start-up Delay | Programmable |

| | **AC** | **DC** |
|---|---|---|
| Max switching voltage | 48V RMS | 48V |
| Max current | 1A @48V | 1A @ 30V |
| Max power | 60VA | 30W |
| Contact resistance | <100mW | |
| Operate time | <5ms | |
| Electrical life @ full load | 100,000 operations | |
| Mechanical life | 10,000,000 operations | |

### 2.2.2 Current Retransmission

| | |
|---|---|
| Output Range | |
| Single Channel | 0-10, 0-20, 4-20 mA source or sink |
| Dual Channel | 4-20mA sink |
| Maximum current output | <23mA |
| Accuracy | 0.07% or 5mA, whichever is greater |
| Max power supply | 30V (In sink mode) |
| Temperature stability | 5mA/°C |

## 2.3 General

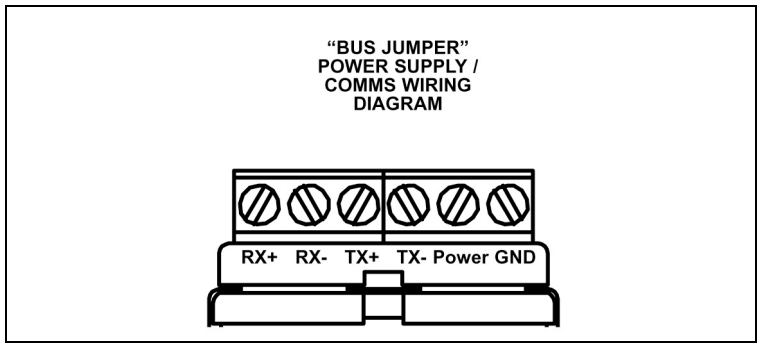
| | |
|---|---|
| EMC Approval: | EN61326: 1997 |
| Immunity: | Annex A Industrial |
| Emmissions: | Class A |
| Response Time | 300mSec typical |
| Filter | Programmable or Adaptive |
| Power Requirements | 24V DC ±10% @200 mA |
| Isolation | 500V AC I/P~O/P~PSU |
| Ambient operating range | -30 to 60°C |
| Ambient storage | -50 to 85°C |
| Ambient humidity | 10 to 90% RH |
| EMC emissions | BS EN50081-1 |
| EMC immunity | BS EN50082-2 |
| Display Range | -1999 to 9999 |

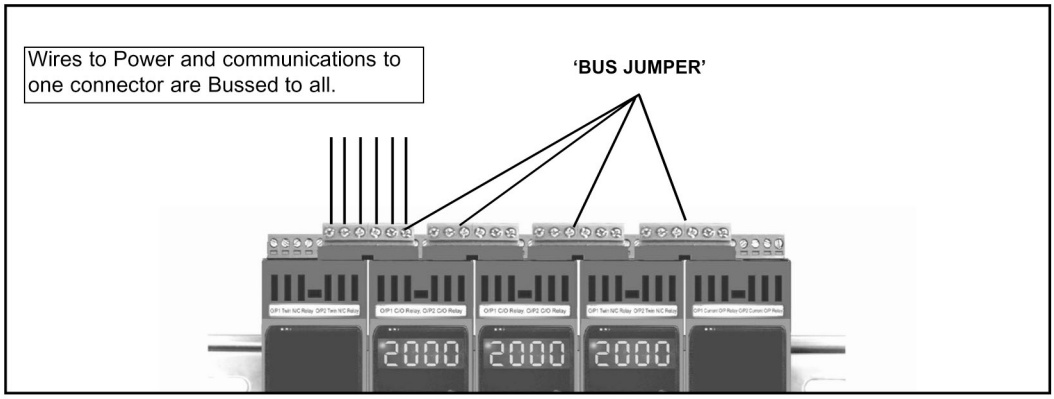
# 3 Electrical Connections

All connections are made to sockets which are removable for ease of maintenance. Installation should be undertaken in accordance with relevant sections of BS6739 - British Standards code of practice for "Instrumentation in Process Control Systems: Installation design and practice".

## 3.1 Power / Comms

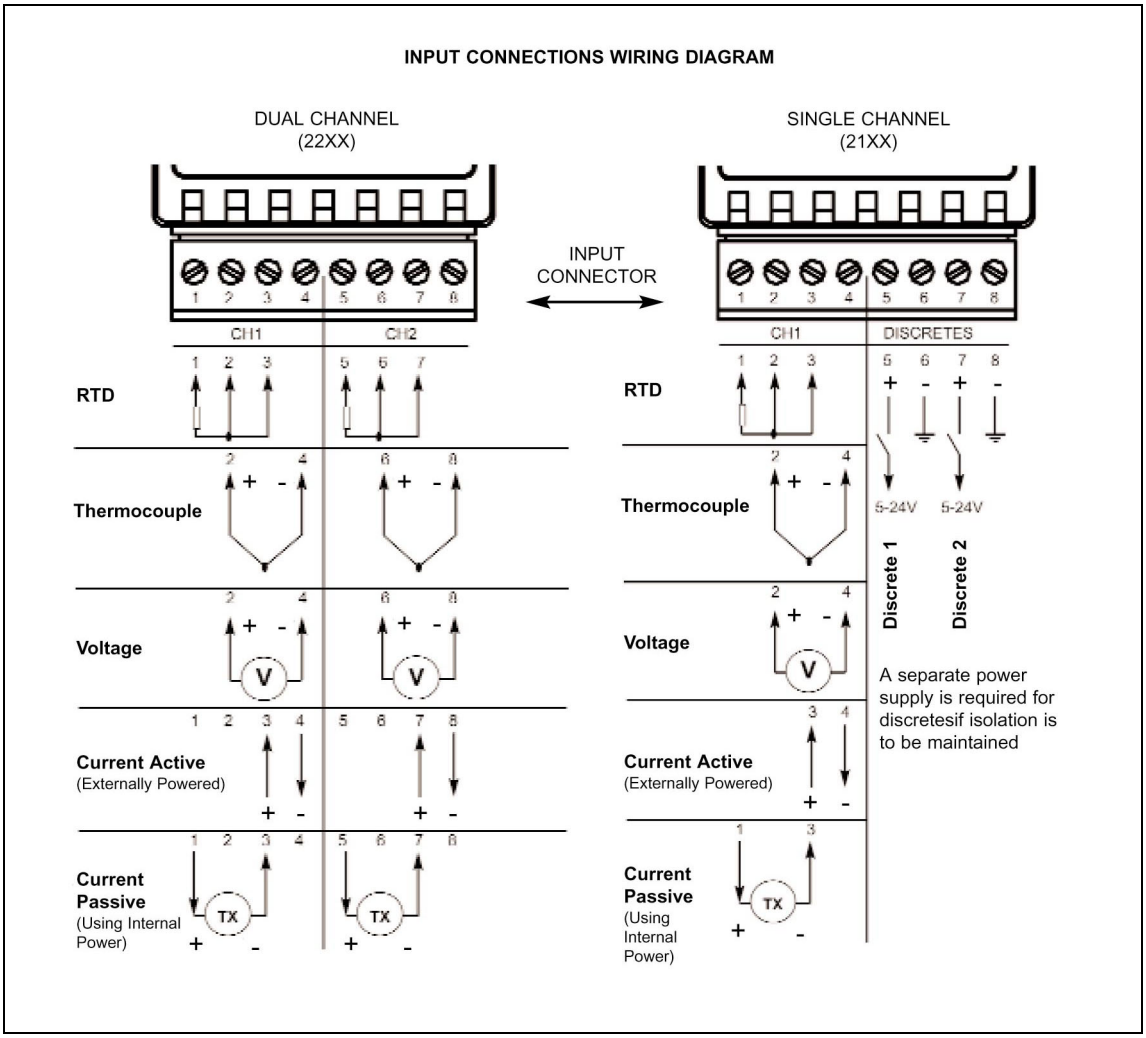
Medacs is provided with a unique 'BUS JUMPER' system for quick wiring of communications and power connections. To use the Bus Jumper, disconnect all power supply/communications connectors and place them so that they connect between the two units. Wiring to one connector then connects to all units. Note that the RX+/- terminals are used when in RS-485 2-wire mode.



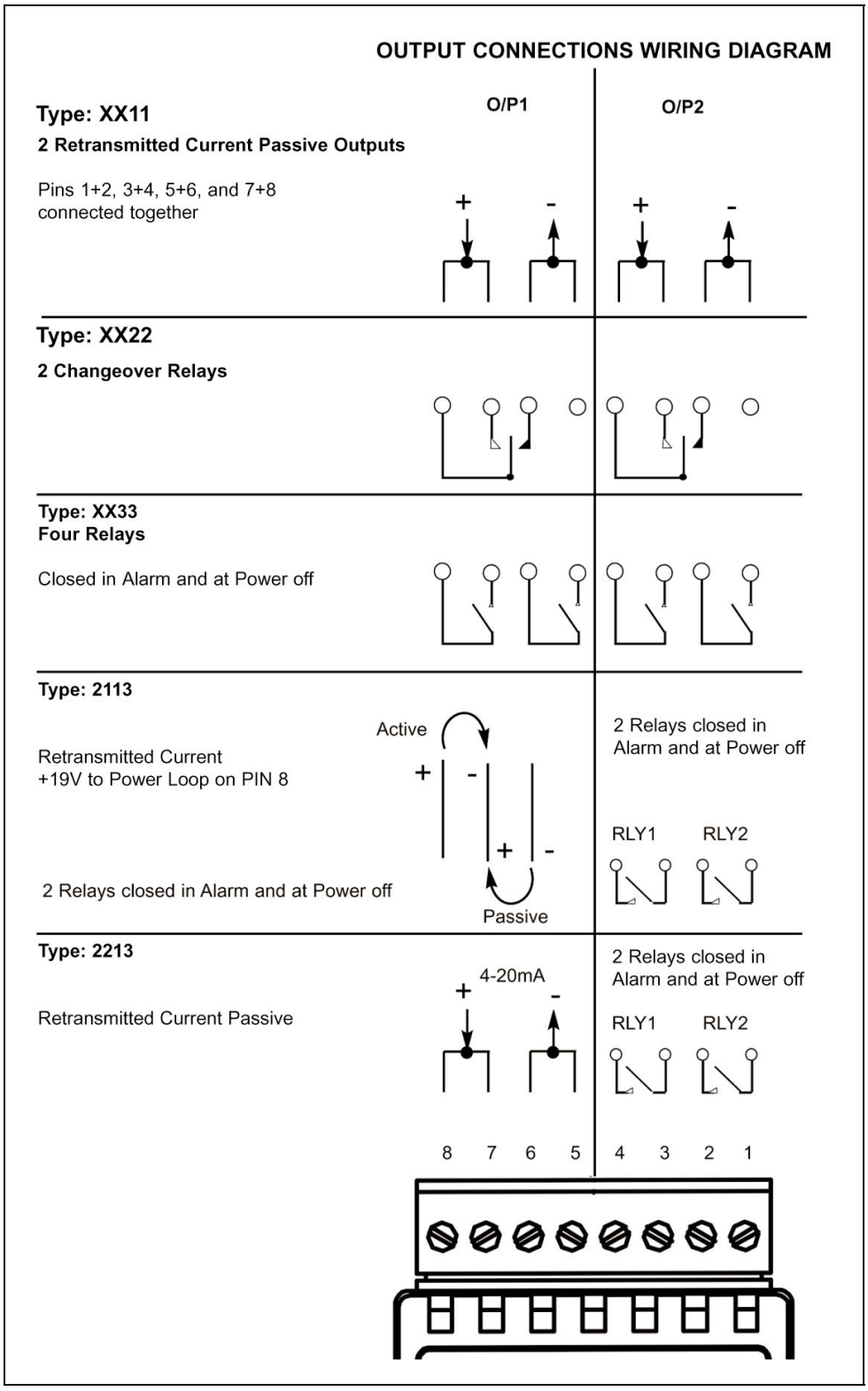




Ensure that the power supply is correct for the application. Over-voltage could damage the instrument. Ensure that the exposed section of the wire is fully inserted and that no loose strands are exposed.

## 3.2 Inputs


INPUT CONNECTIONS WIRING DIAGRAM
DUAL CHANNEL
(22XX)
SINGLE CHANNEL
(21XX)
INPUT
CONNECTOR
CH1
CH2
DISCRETES
RTD
Thermocouple
Voltage
Current Active
(Externally Powered)
Current
Passive
(Using Internal
Power)
TX
V
5-24V
Discrete 1
Discrete 2
A separate power
supply is required for
discretesif isolation is
to be maintained

## 3.3 Outputs


OUTPUT CONNECTIONS WIRING DIAGRAM
O/P1
O/P2
Type: XX11
2 Retransmitted Current Passive Outputs
Pins 1+2, 3+4, 5+6, and 7+8
connected together
+
-
+
-
Type: XX22
2 Changeover Relays
Type: XX33
Four Relays
Closed in Alarm and at Power off
Type: 2113
Retransmitted Current
+19V to Power Loop on PIN 8
Active
+
-
+
-
Passive
2 Relays closed in Alarm and at Power off
2 Relays closed in
Alarm and at Power off
RLY1
RLY2
Type: 2213
Retransmitted Current Passive
4-20mA
+
-
2 Relays closed in
Alarm and at Power off
RLY1
RLY2
8 7 6 5
4 3 2 1

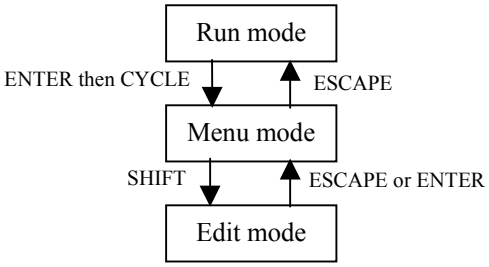
# 4 Menu Programming

## 4.1 Operating Modes

All single channel MEDACS has 3 operating modes. These are:

- Run Mode – Process Variable is displayed.
- Menu Mode – Enables navigation around menu structure.
- Edit Mode – Enables menu parameters to be edited.

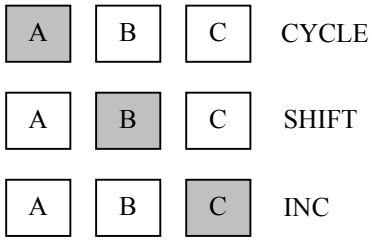
Run mode is the principal mode of operation. The other two modes are accessed as shown in the following diagram.



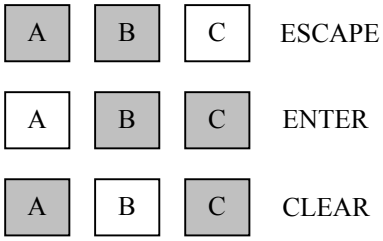

## 4.2 Key Press Definitions

Each MEDACS unit has 3 keys (A, B & C) to enable menu programming.

Each key pressed individually produces the following menu action (shaded square signifies key pressed):



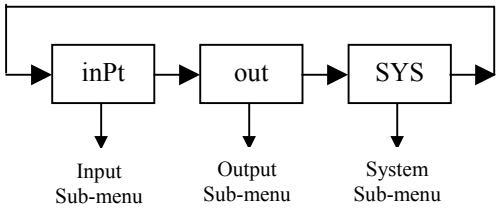

Keys pressed simutaneously produce the following menu actions (shaded square signifies key pressed):



## 4.3 Entering Menu Mode

On power up, the unit(s) will take a few seconds to configure itself. Run mode will then automatically be entered. Menu mode is accessed from run mode by pressing ENTER followed by CYCLE. The user will then be able to move around the root menu.

## 4.4 Root Menu




## 4.5 Navigating Around the Menu

The user can navigate around the root menu (or any sub-menu) by pressing the CYCLE key. Menu navigation wraps around at the end of the menu list. The items displayed in the menu can either be sub-menus, parameter lists or numbers

## 4.6 Entering a Sub-Menu

Pressing SHIFT enters the sub-menu or enables parameter list/number editing, depending on where the menu structure is currently being pointed. If the menu navigation is pointing at a sub-menu, the subsequent sub-menu can then be cycled around using the CYCLE key.

## 4.7 Editing a Parameter List

A parameter is selected from a list of options. The parameter option list can be cycled through by pressing the INC key. The user will be able to distinguish between a menu cycle action, and a parameter list cycle action by having the following 2 dynamic display styles:

| **Action** | **Display Style** |
|---|---|
| Menu Cycle | Display scrolls on cycle press, no flash |
| Parameter List Cycle | Flash display at 1Hz |

While the display is flashing, the option on the display has not been saved to memory. When the desired parameter option is in view, pressing the ENTER key will save it to memory. The display will stop flashing for 1 second to confirm the selection, before returning to the previous sub-menu. Waiting for 1 minute without a key press, or pressing the ESCAPE key will return the user to the previous sub-menu, without saving the selection.

## 4.8 Editing a Number

A number is edited by incrementing each digit in turn. The user will know which digit is currently selected for incrementing by the flashing (@1Hz) of that digit. Pressing the INC key will increment the digit. On overflow, the digit will wrap around to '-' or '0', whichever is applicable. Pressing SHIFT will shift the currently selected digit right one place.

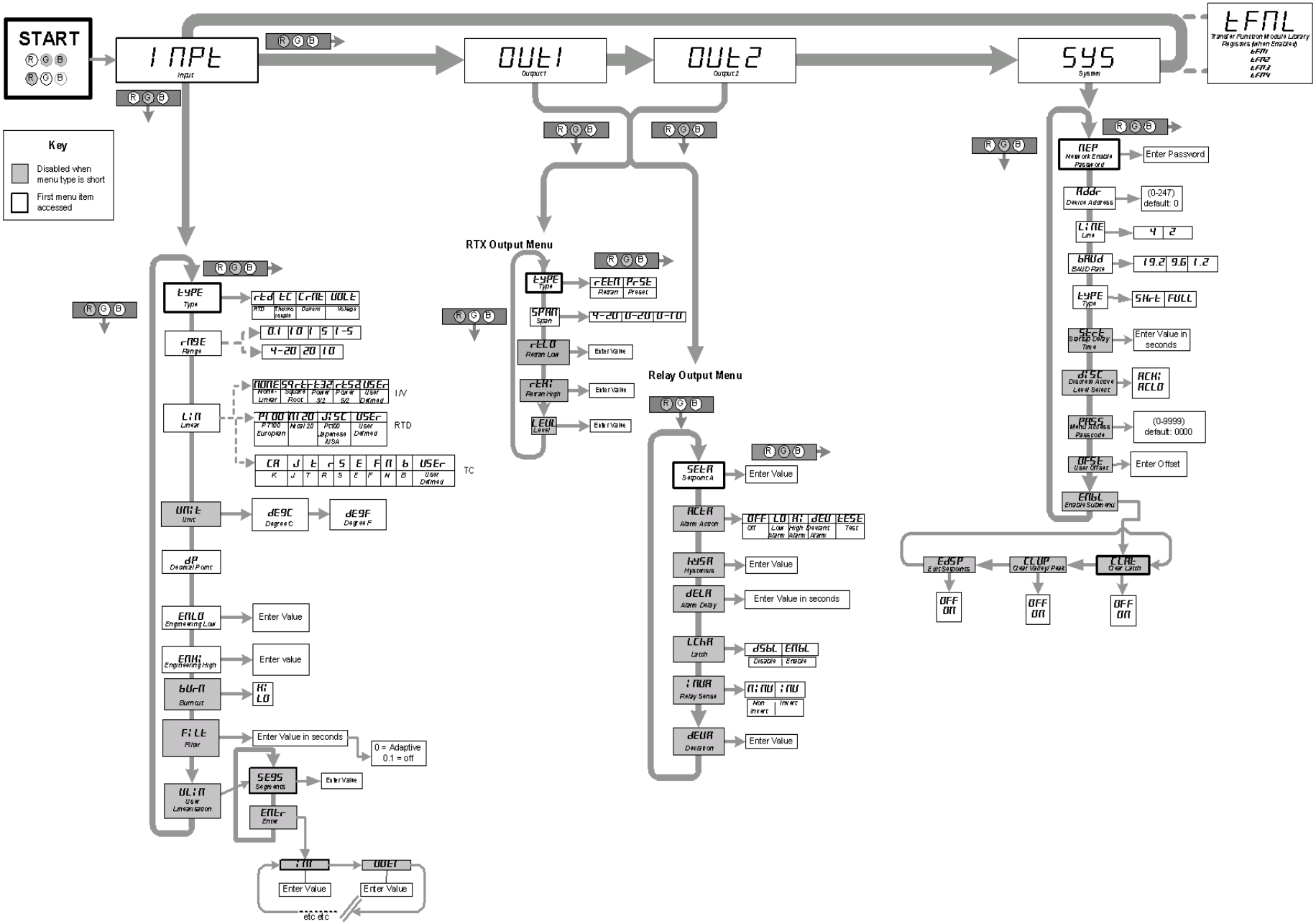
If the number is a whole number, pressing SHIFT when the right most digit is selected will wrap the selection around to the left most digit, and the process starts again.

If the number is a floating point number, pressing SHIFT when the right most digit is selected will select the decimal point position as the editable parameter. In this case, pressing INC will shift the DP position one place to the right. If the current DP position is the right most, the DP will wrap around to the first DP position. Pressing SHIFT will select the left most digit as the editable parameter, and the process starts again.

While the display is flashing, the number on the display has not been saved to memory. When the desired number is in view, pressing the ENTER key will save it to memory. The display will stop flashing for 1 second to confirm the saved number, before returning to the previous sub-menu. Waiting for 1 minute without a key press, or pressing the ESCAPE key will return the user to the previous sub-menu, without saving the number.

## 4.9 Menu Structures

This following describes the menu tree structure through the use of a tree-diagram. The tree-diagram is explained in more detail in the MEDACS Installation guide.


START
INPt
Input
OUt1
Output1
OUt2
Output2
SYS
System
tFNL
Transfer Function Module Library Registers (when Enabled)
tFN1
tFN2
tFN3
tFN4
Key
Disabled when menu type is short
First menu item accessed
tYPE
Type
rtd tC CrNt VOLt
RTD Thermo couple Current Voltage
rNGE
Range
0.1 10 1 5 1-5
4-20 20 10
LIN
Linear
NONE SQrt Pt32 rt32 USEr
None-Linear Square Root Power 3/2 Power 5/2 User Defined
I/V
Pt00 Ni20 JiSC USEr
Pt100 European Ni-120 Pt100 Japanese JISA User Defined
RTD
CA J t r S E F N b USEr
K J T R S E F N B User Defined
TC
UNIt
Unit
dEGC
Degree C
dEGF
Degree F
dP
Decimal Point
EnLO
Engineering Low
Enter Value
EnHi
Engineering High
Enter value
bUrn
Burnout
Hi
LO
FiLt
Filter
Enter Value in seconds
0 = Adaptive
0.1 = off
ULIn
User Linearisation
SEGS
Segments
Enter Value
EntEr
Enter
inP
Enter Value
OUt1
Enter Value
etc etc
RTX Output Menu
tYPE
Type
rEEn PrSt
Retran Preset
SPAn
Span
4-20 0-20 0-10
rELO
Retran Low
Enter Value
rEHi
Retran High
Enter Value
LEVL
Level
Enter Value
Relay Output Menu
SEtA
Setpoint A
Enter Value
ACtA
Alarm Action
OFF LO Hi dEV bAnd
Off Low Alarm High Alarm Deviation Alarm Band Alarm
tESt
Test
hYSA
Hysteresis
Enter Value
dELA
Alarm Delay
Enter Value in seconds
LCkA
Latch
dSbL EnbL
Disable Enable
inVA
Relay Sense
nInV inV
Non Invert Invert
dEVA
Deviation
Enter Value
nEP
Network Enable Password
Enter Password
Addr
Device Address
(0-247) default: 0
LInE
Line
4 2
bAUd
BAUD Rate
19.2 9.6 1.2
tYPE
Type
SHrt FULL
SECt
Startup Delay Time
Enter Value in seconds
diSC
Discrete Active Level Select
ACki ACLO
PASS
Menu Access Passcode
(0-9999) default: 0000
OFSt
User Offset
Enter Offset
EnbL
Enable Submenu
EdSP
Edit Setpoints
CLUP
Clear Valley/Peak
CLAt
Clear Latch
OFF On
OFF On
OFF On

# 5 Modbus

## 5.1 Introduction

It is possible to communicate via MODBUS with products in the MEDACS range.

Modbus is a Master-Slave based communications protocol. This means that all messages may only be initiated by the Master device. In general the Master will communicate with one Slave device at a time, although it is possible under certain circumstances for the Master to broadcast to the entire network.

The MEDACS units are Slave devices and therefore require to be put on a network that has a Master in order to operate. This guide contains sufficient information in order to program and configure the Master Modbus device so that parameters from the MEDACS units may be accessed.

## 5.2 MEDACS Configuration

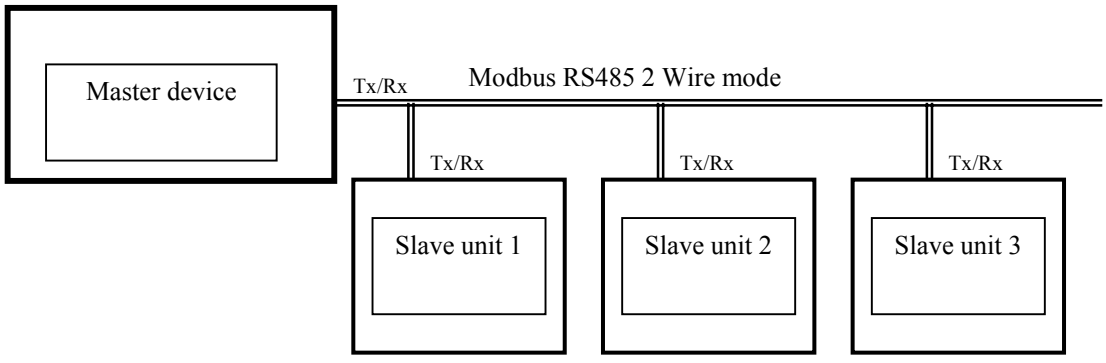
When the unit is powered-up, there will be a communications menu available. There are three items to configure.

Slave Baud rate (bAud) - 19.2Kb, 9.6kB, 1.2kB available
Mode (Line) - 2 wire or 4 wire available
Device Address (Addr) - Network unique address 0-255
(Note that maximum device no. for MODBUS is 247)

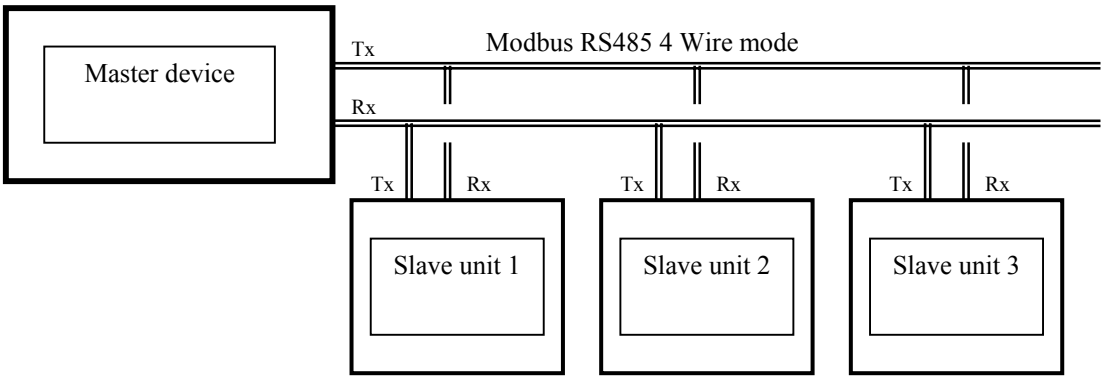
The comms port settings of 1 stop bit, 1 start bit, 8 data bits and no parity is fixed and therefore may not be changed.

The baud rate should be set up for the network. Although it is theoretically possible to set different baud rates for different devices it is recommended that one baud rate is chosen throughout.

The RS485 mode determines the way that the network is connected together. The 2-wire arrangement, shown below, has both transmit and receive signals sharing the same wires. Although this makes most efficient use of the connections and makes wiring simpler, correct operation depends upon critical timing within the Master device. A reply from a Slave device will occur about 5ms after the Master has issued a message, therefore, the Master output buffer needs to be disabled in time to prevent a data clash and a corrupted reply from the Slave.




If 4-wire mode is chosen, the network is wired as shown below and does not have the same critical requirements for Master device message timing as the Master has dedicated transmit lines.




## 5.3 Device addresses

Each Slave unit requires a unique address to be programmed. If two or more units have the same address on the network, both or all will respond when this address is accessed by the Master device and a data corruption will result. Possible addresses range from 1-255; however, Modbus defines a maximum address number of 247. The electrical characteristics of RS485 limit the number of devices on a network to 32; however, buffering the network increases this number.

### 5.3.1 Network Enable Passcode

Each MEDACS unit has a "unique ID" (UID) associated with it. There is a correct Network Enable Passcode (NEP) associated with each UID. A standard MEDACS unit will leave the factory with NEP set to 0, which is the incorrect NEP. When the correct NEP is set, the device address can be set to a non-zero value, thus enabling networked communications. Once the unique ID has been noted (using M-Config) contact the distributor to acquire the correct NEP.

## 5.4 Protocol Format

MEDACS uses the RTU mode of transmission (as opposed to the ASCII mode). The basic Modbus RTU protocol format for both Master and Slaves is as follows:

| Slave Address | Function Code | Data | Error Check |
|---|---|---|---|

The Slave address is as described above.
The Function code defines the type of comms operation. The 3 user function codes supported are listed below.

| Function code | Description |
|---|---|
| 3 | Read holding register(s) value |
| 16 | Write register(s) value |
| 65 | Request unit id |

The Data field is Function code dependent and is detailed in the following sections.

The CRC (Cyclic Redundancy Check) is a 16 bit field transmitted alongside the message and is used to confirm its accuracy. The method of calculation of the CRC is contained in the Appendix to this document.

## 5.5 MEDACS 2000 Modbus Functions

### 5.5.1 Function 3 Read Register

The general format for the read registers request/reply sequence is as follows (each cell represents an eight bit byte):

Request issued from Master.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Slave Address | 3 | Start Addr High | Start Addr Low | No. Regs High | No. Regs Low | CRC Low | CRC High |

The Start Addr High and Low make up a 16 bit register address word. Note that the index of the register allocation table is based from 1 whilst the value that is entered in the comms message is zero based. For example, the address of the Process Variable value stated as '1' in the Register allocation table is entered as 0x0000 in the Modbus comms field.

The Number of registers requested is limited to 8 due to comms buffer restrictions. Therefore the "No. Regs High" field is always set to zero.

A single register represents a 16-bit data field and therefore in order to access a floating-point number, two consecutive registers need to be requested. The format of the number returned is IEEE 754 floating point format. It follows that the maximum number of floating point values that can be requested in a message of this type is limited to 4.

Format of the reply from Slave.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Slave Address | 3 | No. of Bytes | $Reg_n$ High value | $Reg_n$ Low value | | CRC Low | CRC High |

The "No. Of Bytes" value represents the number of bytes of actual data returned. As each register is a 16-bit number, the number of bytes value is the number of registers requested times two.

FUNCTION 3 EXAMPLE

The first 3 registers are to be requested from a MEDACS addressed as device 6. Registers 1 & 2 together constitute an IEEE 754 32 bit floating point number representing the channel 1 process variable(PV). Register 3 is a stand-alone 16 bit register indicating the input type from a list of options. The following message is transmitted by the Master.

| Addr | $Func^n$ | Start Addr High | Start Addr Low | No. Regs High | No. Regs Low | CRC Low | CRC High |
|---|---|---|---|---|---|---|---|
| 6 | 3 | 0 | 0 | 0 | 3 | | |

Although all Slave devices on the network 'hear' the message, only device 6 responds.

| Addr | $Func^n$ | No. of Bytes | $Reg_n$ High value | $Reg_n$ Low value | $Reg_{n+1}$ High value | $Reg_{n+1}$ Low value | $Reg_{n+2}$ High Value | $Reg_{n+2}$ Low value | CRC Low | CRC High |
|---|---|---|---|---|---|---|---|---|---|---|
| 6 | 3 | 6 | 0x41 | 0xC9 | 0x00 | 0x00 | 0x00 | 0x01 | | |

This indicates that:

Process variable = 0x41C90000 = 25.125
Input type = 0x0001 (Thermocouple)

## 5.6 Function 16 Write Register

The general format for the write register request/reply sequence is as follows (each cell represents an eight bit byte):

Request issued from Master.

| Slave Addr | 16 | Start Addr High | Start Addr Low | No. Regs High | No. Regs Low | No. Bytes | $Reg_n$ High value | $Reg_n$ Low value | | CRC Low | CRC High |
|---|---|---|---|---|---|---|---|---|---|---|---|

The Start Addr High and Low make up a 16 bit register address word. Note that the index of the register allocation table is based from 1 whilst the value that is entered in the comms message is zero based.

The Number of registers to be written to is limited to 8 due to comms buffer restrictions. Therefore the "No. Regs High" field is always set to zero.

Format of the reply from Slave.

| Slave Address | 16 | Start Addr High | Start Addr Low | No. Regs High | No. Regs Low | CRC Low | CRC High |
|---|---|---|---|---|---|---|---|

Function 16 will not write to registers 181-300 (inclusive).

Function 16 Example

The engineering_low value on device 111 (0x6F) is to be set to 20.0. The register address for this is 12; this corresponds to a zero based address of 11 (0x0b) for the comms command. Note that for consistency all the byte values are expressed in hexadecimal format. In IEEE 754 format, 20.0 = 0x41a00000.

| Addr | $Func^n$ | Start Addr High | Start Addr Low | No. Regs High | No. Regs Low | No. of Bytes | $Reg_n$ High value | $Reg_n$ Low value | $Reg_{n+1}$ High value | $Reg_{n+1}$ Low value | CRC Low | CRC High |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0x6F | 0x10 | 0x00 | 0x0b | 0x00 | 0x02 | 0x04 | 0x41 | 0xa0 | 0x00 | 0x00 | | |

After setting the engineering_low value to 20.0, device 111 sends the following message in way of acknowledgement.

| Addr | $Func^n$ | Start Addr High | Start Addr Low | No. Regs High | No. Regs Low | CRC Low | CRC High |
|---|---|---|---|---|---|---|---|
| 0x6F | 0x10 | 0x00 | 0x0b | 0 | 2 | | |

## 5.7 Function 65 Request Slave ID

This function is used by the Master to determine the identification of the Slave device.
Request issued from Master.

| Slave Address | 65 | Code High | Code Low | CRC Low | CRC High |
|---|---|---|---|---|---|

The Code High and Low fields are not used and should be set to zero.

Format of the reply from Slave.

| Slave Address | 65 | No. of Bytes (9) | Product Type | Product Input 1 Option | Product Input 2 Option | Product Output 1 Option | Product Output 2 Option | S/W Issue 0 | S/W Issue 1 | S/W Issue 2 | CRC Low | CRC High |
|---|---|---|---|---|---|---|---|---|---|---|---|---|

The number of bytes reflects the number of data items in the reply and is set to 6.

The product type codes are defined as follows:

| **Product type code** | **Product type** |
|---|---|
| 1 | Dual channel transmitter |
| 2 | Single channel transmitter |
| 3 | Single channel indicator |
| 4 | Gateway unit |

The Product input option codes reflect each channel's input option. The input option codes are defined as follows.

| **Product Input Option Code** | **Input Option** |
|---|---|
| 0 | None installed |
| 1 | Universal temperature / process |
| 2 | Frequency |

The Product output option codes reflect the output options available. The output option codes are defined as follows.

| **Product Output Option Code** | **Output Option** |
|---|---|
| 0 | None installed |
| 1 | Retransmission |
| 2 | C/O relay |
| 3 | Twin relay |

The three-byte software code represents the issue date of the instrument software, each nybble representing a BCD number. For example, the S/W issue code 0x12,0x09,0x00 represents 12/9/2000.

## 5.8 Modbus register allocation

This section defines the Modbus allocation of the MEDACS system variables. Registers shown in grey are reserved and should not be accessed by the user.

The register space between registers 61 & 120 describes the output configuration. These registers will depend upon what output option is fitted.

### 5.8.1 Input Parameters

The input can be current (I), voltage (V), RTD or thermocouple (TC).

#### 5.8.1.1 Universal Input

##### 5.8.1.1.1 REGISTERS – CHANNEL 1

| REG | DESCRIPTION | FORMAT | UNITS / LIST OPTIONS / RANGE |
|---|---|---|---|
| 1. | Process variable (HO) | Float | °C, °F, Engineering units |
| 2. | Process variable (LO) | | |
| 3. | Input type | Integer List | RTD, TC, I, V |
| 4. | Linearisation index (RTD) | Integer List | Pt100(Euro), Ni120, Pt100(JISC), Custom |
| 5. | Linearisation index (TC) | Integer List | K,J,T,R,S,E,F,N,B Custom |
| 6. | Linearisation index (I,V) | Integer List | Linear, $X^{1/2}$, $X^{3/2}$, $X^{5/2}$ ,Custom |
| 7. | Filter Factor (HO) | Float | 0: adaptive, 0.3-99.9: time const, 0-0.3: off |
| 8. | Filter Factor (LO) | | |
| 9. | User offset (HO) | Float | Engineering units |
| 10. | User offset (LO) | | |
| 11. | Temperature units (RTD, TC) | Integer List | °C, °F |
| 12. | Input range (I) | Integer List | 4-20mA, ±20mA, ±10mA, |
| 13. | Input range (V) | Integer List | ±100mV, ±10V, ±1V, ±5V, 1-5V |
| 14. | Engineering_low (HO) | Float | Engineering units |
| 15. | Engineering_low (LO) | | |
| 16. | Engineering_high (HO) | Float | Engineering units |
| 17. | Engineering_high (LO) | | |
| 18. | Units string 1 (HO) | 2 char ASCII | |
| 19. | Units string 2 | 2 char ASCII | |
| 20. | Units string 3 | 2 char ASCII | |
| 21. | Tag string 1 (HO) | 2 char ASCII | |
| 22. | Tag string 2 | 2 char ASCII | |
| 23. | Tag string 3 | 2 char ASCII | |
| 24. | Tag string 4 | 2 char ASCII | |
| 25. | Input status | Integer bitmap | See note 5.10.1 |
| 26. | Burnout config | Integer list | Simulate high, low |
| 27. | | | |
| 28. | | | |
| 29. | | | |
| 30. | | | |

#### 5.8.1.1.2 REGISTERS – CHANNEL 2

(only applies to 22XX units )

| REG | DESCRIPTION | FORMAT | UNITS / LIST OPTIONS / RANGE |
|---|---|---|---|
| 31. | Process variable (HO) | Float | °C, °F, Engineering units |
| 32. | Process variable (LO) | | |
| 33. | Input type | Integer List | RTD, TC, I, V |
| 34. | Linearisation index (RTD) | Integer List | Pt100(Euro), Ni120, Pt100(JISC), Custom |
| 35. | Linearisation index (TC) | Integer List | K,J,T,R,S,E,F,N,B Custom |
| 36. | Linearisation index (I,V) | Integer List | Linear, $X^{1/2}$, $X^{3/2}$, $X^{5/2}$ ,Custom |
| 37. | Filter Factor (HO) | Float | 0: adaptive, 0.3-99.9: time const, 0-0.3: off |
| 38. | Filter Factor (LO) | | |
| 39. | User offset (HO) | Float | Engineering units |
| 40. | User offset (LO) | | |
| 41. | Temperature units (RTD, TC) | Integer List | °C, °F |
| 42. | Input range (I) | Integer List | 4-20mA, ±20mA, ±10mA, |
| 43. | Input range (V) | Integer List | ±100mV, ±10V, ±1V, ±5V, 1-5V |
| 44. | Engineering_low (HO) | Float | Engineering units |
| 45. | Engineering_low (LO) | | |
| 46. | Engineering_high (HO) | Float | Engineering units |
| 47. | Engineering_high (LO) | | |
| 48. | Units string 1 (HO) | 2 char ASCII | |
| 49. | Units string 2 | 2 char ASCII | |
| 50. | Units string 3 | 2 char ASCII | |
| 51. | Tag string 1 (HO) | 2 char ASCII | |
| 52. | Tag string 2 | 2 char ASCII | |
| 53. | Tag string 3 | 2 char ASCII | |
| 54. | Tag string 4 | 2 char ASCII | |
| 55. | Input status | Integer bitmap | See note 5.10.1 |
| 56. | Burnout config | Integer list | Simulate high, low |
| 57. | | | |
| 58. | | | |
| 59. | | | |
| 60. | | | |

### 5.8.2 Output Parameters

Register space is shared between relay output variables and current retransmission variables. For example, for a 2133 unit, registers 61 & 62 form the setpoint associated with alarm 1A. For a 2113 unit, register 61 is the retransmission status for current output channel 1.

#### 5.8.2.1 Relay Output

##### 5.8.2.1.1 REGISTERS - CHANNEL 1

| REG | DESCRIPTION | FORMAT | UNITS / OPTIONS / RANGE |
|---|---|---|---|
| 61. | Setpoint A (HO) | Float | Engineering units |
| 62. | Setpoint A (LO) | | |
| 63. | Hysteresis A (HO) | Float | Engineering units |
| 64. | Hysteresis A (LO) | | |
| 65. | Deviation A (HO) | Float | Engineering units |
| 66. | Deviation A (LO) | | |
| 67. | Delay A | Integer | |
| 68. | Alarm A action | Integer list | Off, low, high, deviation, test |
| 69. | Alarm A config | Integer bitmap | See note 5.10.2 |
| 70. | | | |
| 71. | | | |
| 72. | | | |
| 73. | | | |
| 74. | | | |
| 75. | | | |
| 76. | Setpoint B (HO) | Float | Engineering units |
| 77. | Setpoint B (LO) | | |
| 78. | Hysteresis B (HO) | Float | Engineering units |
| 79. | Hysteresis B (LO) | | |
| 80. | Deviation B (HO) | Float | Engineering units |
| 81. | Deviation B (LO) | | |
| 82. | Delay B | Integer | |
| 83. | Alarm B action | Integer list | Off, low, high, deviation, test |
| 84. | Alarm B config | Integer bitmap | See note 5.10.2 |
| 85. | | | |
| 86. | | | |
| 87. | | | |
| 88. | | | |
| 89. | | | |
| 90. | | | |

#### 5.8.2.1.2 REGISTERS - CHANNEL 2

| REG | DESCRIPTION | FORMAT | UNITS / OPTIONS / RANGE |
|---|---|---|---|
| 91. | Setpoint A (HO) | Float | Engineering units |
| 92. | Setpoint A (LO) | | |
| 93. | Hysteresis A (HO) | Float | Engineering units |
| 94. | Hysteresis A (LO) | | |
| 95. | Deviation A (HO) | Float | Engineering units |
| 96. | Deviation A (LO) | | |
| 97. | Delay A | Integer | |
| 98. | Alarm A action | Integer list | Off, low, high, deviation, test |
| 99. | Alarm A config | Integer bitmap | See note 2 |
| 100. | | | |
| 101. | | | |
| 102. | | | |
| 103. | | | |
| 104. | | | |
| 105. | | | |
| 106. | Setpoint B (HO) | Float | Engineering units |
| 107. | Setpoint B (LO) | | |
| 108. | Hysteresis B (HO) | Float | Engineering units |
| 109. | Hysteresis B (LO) | | |
| 110. | Deviation B (HO) | Float | Engineering units |
| 111. | Deviation B (LO) | | |
| 112. | Delay B | Integer | |
| 113. | Alarm B action | Integer list | Off, low, high, deviation, test |
| 114. | Alarm B config | Integer bitmap | See note 2 |
| 115. | Not allocated | | |
| 116. | Not allocated | | |
| 117. | Not allocated | | |
| 118. | Not allocated | | |
| 119. | Not allocated | | |
| 120. | Not allocated | | |

#### 5.8.2.2 Current Output

##### 5.8.2.2.1 REGISTERS – CHANNEL 1

| REG | DESCRIPTION | FORMAT | UNITS / OPTIONS / RANGE |
|---|---|---|---|
| 61. | Retransmission status | Integer list | 4-20mA, 0-20mA, 0-10mA |
| 62. | Retransmission low (HO) | Float | Engineering units |
| 63. | Retransmission low (LO) | | |
| 64. | Retransmission high (HO) | Float | Engineering units |
| 65. | Retransmission high (LO) | | |
| 66. | Preset level (HO) | Float | mA |
| 67. | Preset level (LO) | | |
| 68. | Retransmission type | Integer list | Retransmission, preset |
| 69. | Not allocated | | |
| 70. | Not allocated | | |
| 71. | Not allocated | | |
| 72. | Not allocated | | |
| 73. | Not allocated | | |
| 74. | Not allocated | | |
| 75. | Not allocated | | |
| 76. | Not allocated | | |
| 77. | Not allocated | | |
| 78. | Not allocated | | |
| 79. | Not allocated | | |
| 80. | Not allocated | | |
| 81. | Not allocated | | |
| 82. | Not allocated | | |
| 83. | Not allocated | | |
| 84. | Not allocated | | |
| 85. | Not allocated | | |
| 86. | Not allocated | | |
| 87. | Not allocated | | |
| 88. | Not allocated | | |
| 89. | Not allocated | | |
| 90. | Not allocated | | |

#### 5.8.2.2.2 REGISTERS – CHANNEL 2

| REG | DESCRIPTION | FORMAT | UNITS / OPTIONS / RANGE |
|---|---|---|---|
| 91. | Retransmission status | Integer list | 4-20mA, 0-20mA, 0-10mA |
| 92. | Retransmission low (HO) | Float | Engineering units |
| 93. | Retransmission low (LO) | | |
| 94. | Retransmission high (HO) | Float | Engineering units |
| 95. | Retransmission high (LO) | | |
| 96. | Preset level (HO) | Float | mA |
| 97. | Preset level (LO) | | |
| 98. | Retransmission type | Integer list | Retransmission, preset |
| 99. | Not allocated | | |
| 100. | Not allocated | | |
| 101. | Not allocated | | |
| 102. | Not allocated | | |
| 103. | Not allocated | | |
| 104. | Not allocated | | |
| 105. | Not allocated | | |
| 106. | Not allocated | | |
| 107. | Not allocated | | |
| 108. | Not allocated | | |
| 109. | Not allocated | | |
| 110. | Not allocated | | |
| 111. | Not allocated | | |
| 112. | Not allocated | | |
| 113. | Not allocated | | |
| 114. | Not allocated | | |
| 115. | Not allocated | | |
| 116. | Not allocated | | |
| 117. | Not allocated | | |
| 118. | Not allocated | | |
| 119. | Not allocated | | |
| 120. | Not allocated | | |

### 5.8.3 Other Data

| REG | DESCRIPTION | FORMAT | UNITS / OPTIONS / RANGE |
|---|---|---|---|
| 121. | O/P config 1 | Integer list | none, rtx, c/o, twin |
| 122. | O/P config 2 | Integer list | none, rtx, c/o, twin |
| 123. | Display resolution | Integer list | 0,1,2,3 dec places |
| 124. | Menu passcode | Integer | 0 to 9999 |
| 125. | Modbus device number | Integer | 0 to 247 |
| 126. | Comms baud rate | Integer list | 19k2,9k6,1k2 baud |
| 127. | Number of wires | Integer list | 4 wire,2 wire |
| 128. | General status | Integer bitmap | See note 5.10.6 |
| 129. | | | |
| 130. | Output startup delay (HO) | Float | 5-3600 seconds |
| 131. | Output startup delay (LO) | | |
| 132. | Ch1 peak (HO) | Float | |
| 133. | Ch1 peak (LO) | | |
| 134. | Ch1 valley (HO) | Float | |
| 135. | Ch1 valley (LO) | | |
| 136. | | | |
| 137. | | | |
| 138. | | | |
| 139. | | | |
| 140. | | | |
| 141. | | | |
| 142. | Message (HO) | 32 char string | |
| 143. | Message | | |
| 144. | Message | | |
| 145. | Message | | |
| 146. | Message | | |
| 147. | Message | | |
| 148. | Message | | |
| 149. | Message | | |
| 150. | Message | | |
| 151. | Message | | |
| 152. | Message | | |
| 153. | Message | | |
| 154. | Message | | |
| 155. | Message | | |
| 156. | Message | | |
| 157. | Message (LO) | | |
| 158. | Tag (HO) | 8 char string | |
| 159. | Tag | | |
| 160. | Tag | | |
| 161. | Tag (LO) | | |
| 162. | Descriptor (HO) | 16 byte string | |
| 163. | Descriptor | | |
| 164. | Descriptor | | |
| 165. | Descriptor | | |
| 166. | Descriptor | | |
| 167. | Descriptor | | |
| 168. | Descriptor | | |
| 169. | Descriptor (LO) | | |
| 170. | Network enable password | Integer | 0 to 9999 |
| 171. | | | |
| 172. | | | |

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|---|---|---|---|
| 173 | | | |
| 174 | | | |
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| 176 | | | |
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| 180 | | | |
| 181 | | | |
| 182 | S/W revision (HO) | 8 char string | |
| 183 | S/W revision | | |
| 184 | S/W revision | | |
| 185 | S/W revision (LO) | | |
| 186 | Manufacture Date (HO) | Long int | Num secs since 01/01/2000 00:00 |
| 187 | Manufacture Date (LO) | | |
| 188 | Discrete map | Integer bitmap | See note 5.10.5 |
| 189 | | | |
| 190 | Isolate word | Integer bitmap | See note 5.10.7 |
| 191 | alarm state | Integer bitmap | See note 5.10.3 |
| 192 | relay state | Integer bitmap | See note 5.10.4 |
| 193 | | | |
| 194 | | | |
| 195 | | | |
| 196 | | | |
| 197 | CJ_temp (HO) | Float | °C |
| 198 | CJ_temp (LO) | | |
| 199 | | | |
| 200 | | | |
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| 202 | | | |
| 203 | | | |
| 204 | | | |
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| 217 | | | |
| 218 | | | |
| 219 | | | |
| 220 | | | |
| 221 | | | |
| 222 | | | |
| 223 | current o/p retran level 1 (HO) | Float | mA |
| 224 | current o/p retran level 1 (LO) | | |
| 225 | | | |
| 226 | | | |
| 227 | current o/p retran level 2 (HO) | Float | mA |
| 228 | current o/p retran level 2 (LO) | | |

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|---|---|---|---|
| 229. | | | |
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| | | | |
|---|---|---|---|
| 285. | TFML_float_1 (HO) | Float | |
| 286. | TFML_float_1 (LO) | | |
| 287. | TFML_float_2 (HO) | Float | |
| 288. | TFML_float_2 (LO) | | |
| 289. | TFML_float_3 (HO) | Float | |
| 290. | TFML_float_3 (LO) | | |
| 291. | TFML_float_4 (HO) | Float | |
| 292. | TFML_float_4 (LO) | | |
| 293. | | | |
| 294. | | | |
| 295. | | | |
| 296. | | | |
| 297. | | | |
| 298. | | | |
| 299. | | | |
| 300. | | | |

## 5.9 User Defined Area (UDA) Operation

Vn denotes a floating point number.

| Modbus Address | Single chan unit | Dual chan unit | |
|---|---|---|---|
| 301 | UDAID (zero) | UDAID (zero) | Channel 1 |
| 302 | Order (0-interp, >0-poly) | Order (0-interp, >0-poly) | |
| 303 | Segment (<=59) | Segment (<=29) | |
| 304 | V1 | V1-1 | |
| 305 | | | |
| 306 | V2 | V1-2 | |
| 307 | | | |
| | | | |
| | | | |
| 422 | V60 | V1-60 | |
| 423 | | | |
| 424 | V61 | CJ coefficient 1-A | |
| 425 | | | |
| 426 | V62 | | |
| 427 | | | |
| 428 | V63 | Order2 (0-interp, >0-poly) | Channel 2 |
| 429 | | Segment2 (<=29) | |
| 430 | V64 | V2-1 | |
| 431 | | | |
| 432 | V65 | V2-2 | |
| 433 | | | |
| | | | |
| | | | |
| 542 | V120 | V2-57 | |
| 543 | | | |
| 544 | CJ coefficient A | V2-58 | |
| 545 | | | |
| 546 | | V2-59 | |
| 547 | | | |

| Modbus Address | Single chan unit | Dual chan unit | |
|---|---|---|---|
| 548 | | V2-60 | |
| 549 | | | |
| 550 | | CJ coefficient 2-A | |
| 551 | | | |

The UDA is an area of non-volatile memory where either user-linearisation data, or TFML modules are stored. If a TFML module is loaded into the unit, the standard user-linearisation functions described in this section will be disabled. If a custom TFML is required which uses user-linearisation, the relevant data can be written into the TFML module.

If the UDAID is set to 0, any TFML module loaded is paused. If the relevant linearisation index is set to the 'custom linearisation' value, then user-linearisation will be performed. If 'order' is set to zero, interpolation is performed, otherwise polynomial linearisation is performed.

For interpolation, 'segments' defines the number of interpolated segments to be used.

For polynomial linearisation, 'order' defines the order of the polynomial to be applied. If 'order' is set to a value greater than 15, performance will be unpredictable.

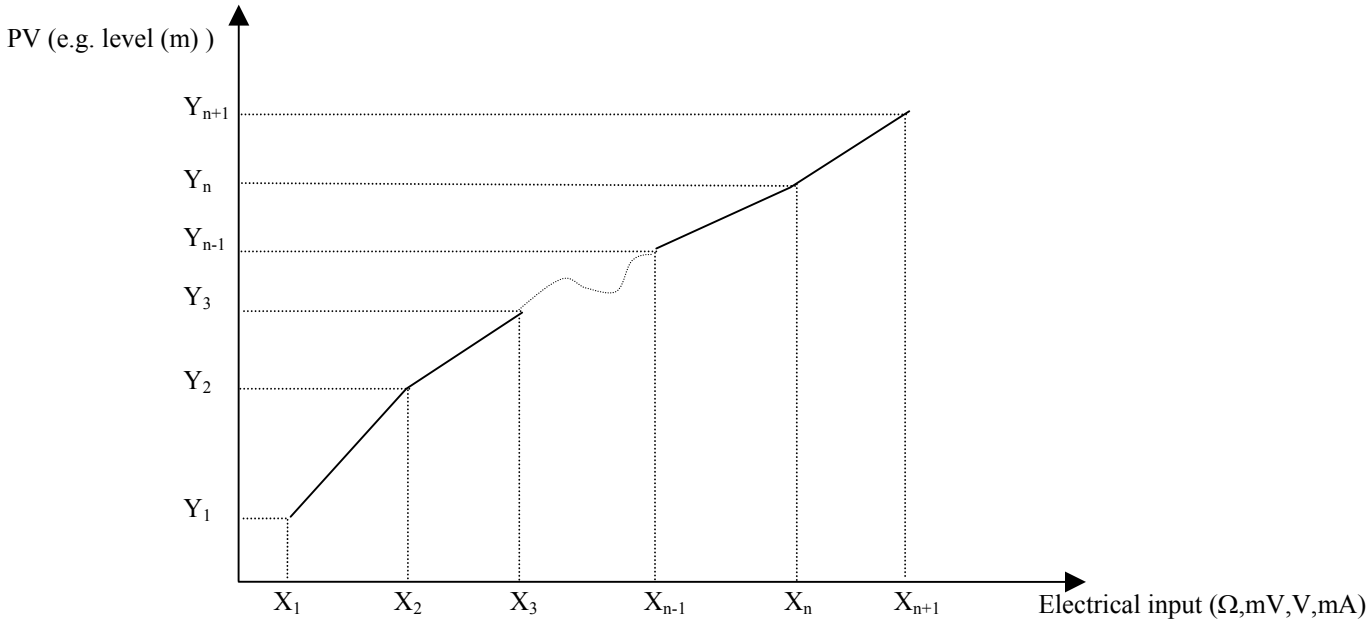
| | TFML | Polynomial | Interpolation |
|---|---|---|---|
| UDAID | 1 | 0 | 0 |
| Order | 0 | 1 to 15 | 0 |
| Segment | 0 | 1 to 19 (dual chan)<br>1 to 39 (single chan) | 1 to 29 (dual chan)<br>1 to 59 (single chan) |

### 5.9.1 Interpolation

For interpolation, numbers are entered into the UDA as follows:

Order = 0
Segment = Number of interpolated segments = Number of co-ordinate pairs – 1.
V1 = electrical input co-ordinate 1
V2 = PV co-ordinate 1
V3 = electrical input co-ordinate 2
V4 = PV co-ordinate 2
etc…..

For n segments, we have n+1 co-ordinate pairs as shown below.




If the electrical input goes below $X_1$, or above $X_{n+1}$, the input is flagged as being over-range. If the user requires strict out of range control, a single segment interpolation can be applied.

#### 5.9.1.1 Interpolation Limits

A single channel MEDACS can store up to 60 co-ordinate pairs of interpolation data.
A dual channel MEDACS can store up to 30 co-ordinate pairs of interpolation data per channel.

### 5.9.2 Segmented Polynomials

For segmented polynomials, numbers are entered into the UDA as follows:

Order = R = 1 to 15, the order of the polynomial to be applied
Segment = Number of segmented polynomials
V1 =lowest electrical input boundary
V2 = $0^{th}$ order coefficient
V3 = $1^{st}$ order coefficient
V4 = $2^{nd}$ order coefficient
.
.
.
V(R+2) = $R^{th}$ order coefficient
V(R+3) = next electrical input boundary
V(R+4) = $0^{th}$ order coefficient
etc…..

For example, if a 2 segment, $3^{rd}$ order polynomial needed to be applied as follows, where V is the electrical input and PV is the process variable.

$$PV = A_0 + A_1V + A_2V^2 + A_3V^3 \qquad \text{for} \qquad 0 < V \leq 0.5$$
$$PV = B_0 + B_1V + B_2V^2 + B_3V^3 \qquad \text{for} \qquad 0.5 < V \leq 1$$

then data would be entered as follows

Order = 3
Segment = 2

V1 =0
V2 = $A_0$
V3 = $A_1$
V4 = $A_2$
V5 = $A_3$
V6 = 0.5
V7 = $B_0$
V8 = $B_1$
V9 = $B_2$
V10 = $B_3$
V11 = 1

#### 5.9.2.1 Polynomial Linearisation Limits

Take the number of floats required to store the full segmented polynomial characteristics to be N.
Take the order of the polynomials to be R.
Take the number of segments to be S.

N = S(R+2) + 1 where R < 16

For a single channel device, N=120 due to the size limitation of the UDA. Therefore, a single channel MEDACS can store up to 7 15$^{th}$ order polynomials, 13 7$^{th}$ order polynomials or 29 2$^{nd}$ order polynomials.

For a dual channel device, N=60 (per channel) due to the size limitation of the UDA. Therefore, a dual channel MEDACS can store up to 3 15$^{th}$ order polynomials, 6 7$^{th}$ order polynomials or 14 2$^{nd}$ order polynomials per channel.

### 5.9.3 Cold Junction Compensation

When custom linearisation is selected for a thermocouple input, the correct cold junction compensation coefficient must be entered. (Note that, for standard thermocouple signal processing, CJ compensation is performed to 2$^{nd}$ order accuracy. For custom thermocouple signal processing, however, CJ compensation is simple 1$^{st}$ order, thus only one CJ coefficient is required.)

CJ compensation is applied as follows:

CJ compensated voltage input (in volts) = voltage input + (CJ_coefficient*T)

where T = ambient temperature (°C)

CJ_coefficient = $\frac{dV}{dt}$ for cold junction (V/°C)

then linearisation is performed on the CJ compensated voltage value.

### 5.9.4 Interpolation Electrical Units

For any voltage input (including thermocouple inputs), the electrical values for interpolation are input in volts.

For a current input, the electrical values for interpolation are input in mA.

For an RTD input, the electrical values for interpolation are input in Ω.

## 5.10 Modbus Register Notes

### 5.10.1 Input status bitmap

| - | Elec over | Elec under | Cal data corrupt || - | ADC out of range | ADC Comms | ADC fault |

A high bit indicates true.

### 5.10.2 Alarm config bitmap

| - | - | - | - || - | - | invert | latch |

Invert bit set indicates that alarm on / relay closed sense is inverted
Latch bit set indicates that alarms are latched

### 5.10.3 Alarm state bitmap

| - | - | - | - || alarm2B | alarm2A | alarm1B | alarm1A |

A '1' indicates in alarm
A '0' indicates not in alarm

### 5.10.4 Relay state bitmap

| - | - | - | - || relay2B | relay2A | relay1B | relay1A |

A '1' indicates relay closed
A '0' indicates relay open

### 5.10.5 Discrete map format

| - | - | dis2_state | dis1_state || - | - | dis2_ip | dis1_ip |

| Bit | High | Low |
|---|---|---|
| dis1_ip | discrete 1 ip hi | discrete 1 ip lo |
| dis2_ip | discrete 2 ip hi | discrete 2 ip lo |
| dis1_state | dis1 is active | dis1 is inactive |
| dis2_state | dis2 is active | dis2 is inactive |

Note – the sense of ip/active is defined by the state of the disc_act bit in gen_status, below

### 5.10.6 General status bitmap

|-|-|-| disc_act || clear peak/valley enable | set_edit_enable | clear_latch_enable | menu_type |
|-|-|-| hi-acthi/lo-actlo || hi-en/lo-dis | hi-en/lo-dis | hi-en/lo-dis | hi-full/lo-short |

### 5.10.7 Isolate word bitmap

| - | I6 | I5 | I4 || I3 | I2 | I1 | I0 |

# 6 MEDACS Functionality

This section describes the standard functionality of the MEDACS units.

## 6.1 Input Scaling

The user must configure the MEDACS unit to accept RTD, thermocouple (TC), current or voltage input. MEDACS processes the electrical input into a Process Variable (PV) as described in the following sections.

### 6.1.1 RTD

All MEDACS units contain linearisation data for all of the RTD types listed in the MEDACS specification. When RTD has been selected, the user must select the RTD type in order for the temperature to be processed as PV. The temperature units can be configured to be °C or °F. The input will be flagged as out of range when it goes out of the stated operating range.

If required, custom linearisation can be applied as described in section 5.9.

### 6.1.2 Thermocouple

All MEDACS units contain linearisation data for all of the TC types listed in the MEDACS specification. When TC has been selected, the user must select the TC type in order for the temperature to be processed as PV. The temperature units can be configured to be °C or °F. Cold junction compensation is automatically applied accordingly. The input will be flagged as out of range when it goes out of the stated operating range.

If required, custom linearisation can be applied as described in section 5.9.

### 6.1.3 Current / Voltage

Engineering_low & engineering_high are related to the input range as shown below:

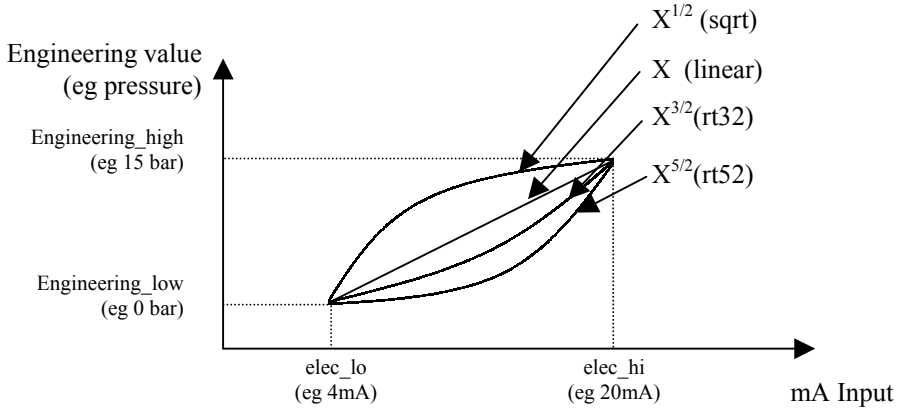



**Figure 1 – Current/Voltage Input Scaling**

The elec_hi/elec_lo values vary according to the current range selected, as in the table below.

| Range | Elec lo | Elec hi |
|---|---|---|
| 4-20mA | 4mA | 20mA |
| ±20mA | 0mA | 20mA |
| ±10mA | 0mA | 10mA |
| ±100mV | 0mV | 100mV |
| ±10V | 0V | 10V |
| ±1V | 0V | 1V |
| ±5V | 0V | 5V |
| 1-5V | 1V | 5V |

Input scaling continues beyond the electrical high/low values, until the A/D converter input is saturated. The input is then flagged as being out of range. The A/D converter saturation limits are well beyond the operating range, though the exact saturation value for each range varies for each MEDACS. If the user requires strict control over when the input goes out of range, user-linearisation (simple interpolation) should be used, as described in section 5.9.

### 6.1.4 Out of Range Action

When an input goes out of range, the following occurs.

If fitted, any relays derived from the out of range input go into alarm state.
If fitted, the retransmitted current derived from the out of range input goes to 3.6mA or 21.5mA, depending on whether burnout is set to low or high, respectively.
On single channel units, the display shows '----'.

### 6.1.5 Clear Function

When enabled (i.e. depending on Clear Latch Enable setting (in the Enable submenu, or the general status bitmap via comms, see section 5.10.6)), alarm latches can be cleared in run mode by pressing the CLEAR keys.

When enabled (i.e. depending on Clear Peak/Valley Enable setting (in the Enable submenu, or the general status bitmap via comms, see section 5.10.6)), peak/valley can be cleared in run mode by pressing the CLEAR keys.

### 6.1.6 Edit Setpoints

When enabled (i.e. depending on Setpoint Enable setting (in the Enable submenu, or the general status bitmap via comms, see section 5.10.6)), setpoints can be edited from run mode by pressing CYCLE.

### 6.1.7 Discrete Inputs

The discrete bitmap (see section 5.10.5) indicates the state of the 2 discrete inputs. There are 2 bits which indicate whether the discrete inputs are high or low, and another 2 bits to indicate whether the discrete inputs are active or not active. The active sense can be inverted by:

Setting 'Achi' or 'Aclo' in the 'disc' option of the 'SYS' sub-menu, or:
Setting the relevant bit in the general status bitmap (see section 5.10.6).

When activated (in the SYS submenu, or the general status bitmap via comms, see section 5.10.6)), discrete 1 has the same functionality as the Clear function.

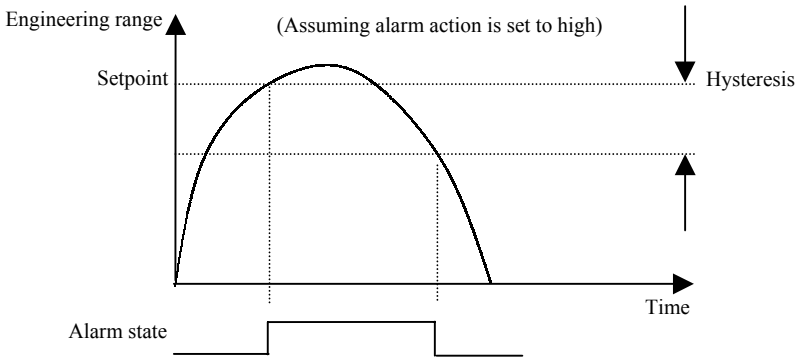
## 6.2 Alarms / relays

The setpoint value determines the engineering value associated with an alarm.
The alarm action determines how the alarm is to operate.

| Alarm action integer variable | Alarm action selected |
|---|---|
| 0 | Off – alarm action disabled |
| 1 | Low alarm – triggers when PV goes below setpoint |
| 2 | High alarm – triggers when PV goes above setpoint |
| 3 | Deviation alarm – triggers at deviation from setpoint |

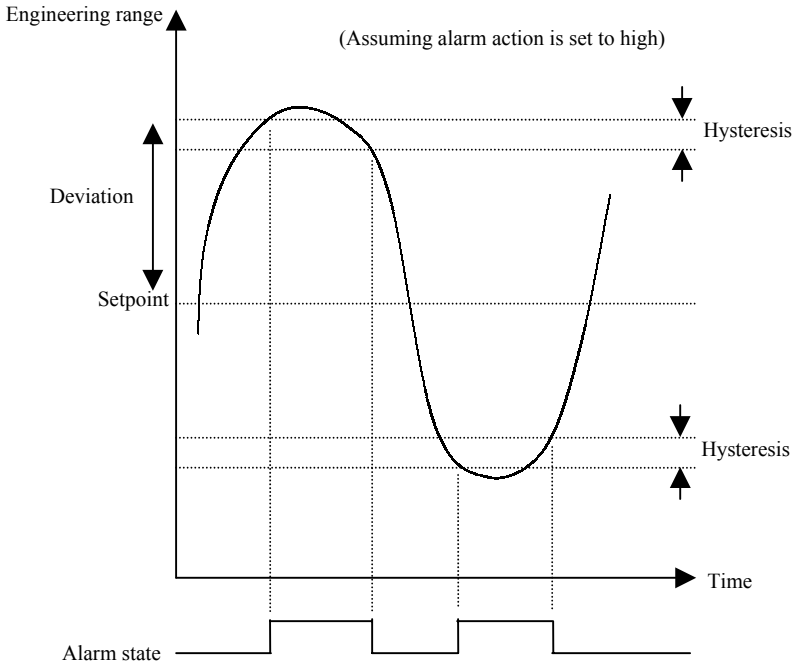
### 6.2.1 Hysteresis

The hysteresis value is the difference between the points at which the alarm triggers and releases, expressed in the relevant engineering unit. The alarm triggers at the set point, and is cleared at the hysteresis level away from the set point. See diagram below.




### 6.2.2 Deviation

When the alarm action is set to deviation, the deviation value (expressed as a % of the engineering range) determines the amount by which the process variable may change before the alarm condition is activated. See diagram below.



### 6.2.3 Latched Alarms

When alarm latching is enabled, if an alarm state is reached, the alarm state will be maintained until the alarm is manually cleared (using CLEAR button press, or asserting discrete 1) or power is removed.

### 6.2.4 Closed-in-Alarm Type Relay – State Table

| Relay Alarm Status | Relay Invert Status | Relay Contacts |
|---|---|---|
| High | Low (non-inverting) | Closed |
| Low | Low (non-inverting) | Open |
| High | High (inverting) | Open |
| Low | High (inverting) | Closed |

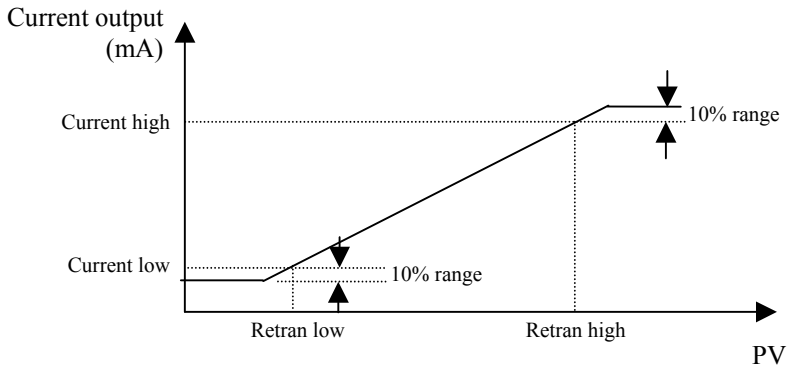
### 6.2.5 Changeover Type Relay - State Table

| Relay Alarm Status | Relay Invert Status | Relay Contacts |
|---|---|---|
| High | Low (non-inverting) | A-B |
| Low | Low (non-inverting) | A-C |
| High | High (inverting) | A-C |
| Low | High (inverting) | A-B |

## 6.3 Retransmitted Current Output

If the retransmission type is set to preset, the user can set any preset level output current. It is the user's responsibility to ensure that this current is in the range 0-22mA. If the current is set outside this range, the actual current output level will be unpredictable.

If the retransmission type is set to retransmission, the retransmission high/low values must be configured to achieve desired operation.




The current high/low values will be set by choosing 1 of the 3 possible retransmission ranges: 4-20mA, 0-20mA or 0-10mA.

## 6.4 Resetting MEDACS Configuration

There is a reset button on the underside of every MEDACS unit, accessible with a small screwdriver via the lower case vents. In order to reset all configuration settings, this button must be pressed with power off, then remain pressed for 1 second after power-on. This will reset almost all configuration settings to their default states, as the following sections show. Any configuration setting not listed here will be unaffected when performing a reset. A reset is irreversible, and must be performed with caution.

### 6.4.1 General Configuration

The following applies only to single channel MEDACS units.

| | | |
|---|---|---|
| Discretes active level | : | high |
| Clear peak / valley | : | disabled |
| Clear latched alarms | : | disabled |
| Edit setpoints | : | disabled |
| Menu type | : | short |
| Display resolution | : | 1 decimal place |

The following applies to any MEDACS unit.

| | | |
|---|---|---|
| Comms baud rate | : | 19k2 |
| Modbus device address | : | 0 |
| RS-485 mode | : | 4 wire |

### 6.4.2 Input(s) Configuration

Each of the following applies for each input channel.

| | | |
|---|---|---|
| Input type | : | RTD |
| Linearisation type | : | Pt100(BS EN 60751) |
| Engineering low/high | : | 0/100 |
| Offset | : | 0 |
| Filter factor | : | 0.1 (i.e. no filter applied) |
| Burnout | : | Low |

### 6.4.3 Outputs Configuration

| | | |
|---|---|---|
| Output startup delay | : | 5 seconds |

Each of the following applies to each alarm/relay output.

| | | |
|---|---|---|
| Setpoint | : | 0 |
| Hysteresis | : | 0 |
| Deviation | : | 0 |
| Alarm delay | : | 0 |
| Alarm action | : | High alarm |
| Latch configuration | : | Not latched |
| Alarm-relay sense | : | Non-inverting |

Each of the following applies to each retransmitted current output

| | | | |
|---|---|---|---|
| Retransmission type | : | Retransmission (not preset) | |
| Span | : | 4-20mA | |
| Retransmission low/high | : | 0/100 | |
| Preset level | : | 10mA | (This level will only be applied when ‘preset’ type is selected) |